

INCH-POUND

MIL-PRF-1/1239E
2 July 1999
SUPERSEDING
MIL-E-1/1239D
3 September 1980

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, POWER TYPES 6816 AND 6884

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Tetrode, UHF, ceramic-metal.
Outline: See figure 1.
Mounting position: Any.
Weight: 2 ounces (56.7 grams) nominal.

ABSOLUTE RATINGS: F1 = 1,215 MHz

Parameter: Unit:		Ef V <u>2</u> /	Eb V dc	Ec1 V dc	Ec2 V dc	Ib mA dc	Ic1 mA dc	Pg2 W	Pp W	Pi W	T(seal) °C <u>3</u> /	tk sec (min)
AB Audio:	Type											
	6816	6.3 ± 10 %	1,000	---	300	180	30	4.5	115	180	250	60
	6884	26.5 ± 10 %	1,000	---	300	180	30	4.5	115	180	250	60
AB SSBSC:	6816	6.3 ± 10 %	1,000	---	300	250	30	4.5	115	180	250	60
	6884	26.5 ± 10 %	1,000	---	300	250 <u>4</u> /	30	4.5	115	180	250	60
C Telep:	6816	6.3 ± 10 %	800	-100	300	150	30	3.0	75	120	250	60
	6884	26.5 ± 10 %	800	-100	300	150	30	3.0	75	120	250	60
C Teleg:	6816	6.3 ± 10 %	1,000	-100	300	180	30	4.5	115	180	250	60
	6884	26.5 ± 10 %	1,000	-100	300	180	30	4.5	115	180	250	60
Test conditions:	6816	6.3	1,000	Adjust	300	---	---	---	---	---	---	60
	6884	26.5	1,000	Adjust	300	---	---	---	---	---	---	60

See footnotes at end of table I.

GENERAL:

Qualification - Required.

TABLE I. Testing and inspection.

Inspection	Method	Notes	Condition	Symbol	Limits		Unit
					Min	Max	
<u>Conformance inspection, part 1</u>							
Total grid current	1266	<u>7/</u>	Ec1/lb = 115 mA dc	Ic1	---	-8	μA dc
Electrode current (screen)	1256	---	Ec1/lb = 115 mA dc	Ic2	-8.0	2.0	mA dc
Electrode voltage (1) (grid)	1261	---	Ec1/lb = 115 mA dc	Ec1	-6	-15	V dc
Electrode voltage (2) (grid)	1261	---	Ec1/lb = 1.0 mA dc	Ec1	---	-48	V dc
Pulsing emission	1231	<u>8/</u>	etd/ik = 10 a	etd	---	300	v
<u>Conformance inspection, part 2</u>							
Heater current	1301	---	Type 6816 Ef only	If	1.84	2.26	A
		---	Type 6884 Ef only	If	0.48	0.60	A
Primary grid emission (control)	1266	---	Eg1/g1 input = 2 W; t = 30; anode and g2 grounded	Isg1	---	-2	μA dc
Primary grid emission (screen)	1266	---	Eg2/g2 input = 4.5 W; t = 30; anode and g1 grounded	Isg2	---	-3	μA dc
Interelement leakage resistance, cold	1366	<u>6/</u>	Supply voltage = 200 V dc	R	1.0	---	Meg
Power output	2214	<u>5/</u>	F = 400 ± 20 MHz; Ib = 180 mA dc (max); Ic1 = 30 mA dc (max); t = 120; Pd = 3.3 W (max); Type 6816 Ef = 5.7 V Type 6884 Ef = 24.0 V	Po	80	---	W (useful)
Power oscillation	1236	---	F = 15 MHz; Eb = 850 V dc; Ec2 = 300 V dc (max); Ib = 150 mA dc; Rg1 = 4,000 ohms (max); Ic1 = 30 mA dc; Pg2 = 4.5 W (max); t = 120	Po	80	---	W (useful)
Current division (method A)	1372	---	Eb = 350 V dc; Ec1 = -100 V dc; egk/lb = 0.6 a; prr = 10 to 12; tp = 4,500 to 5,000 μs	egk	-3.0	+17	v
				ic1	0	130	ma
				ic2	10	70	ma
Electrode current (positive grid)	1256	---	Ec1 = +2 V dc; anode and g2 floating; no other voltages except Ef	Ic1	6	---	mA dc
Direct-interelectrode capacitance	1331	---	Use capacitance fixture in accordance with 289-JAN	Cg1k	11.0	15.0	pF
				Cg1g2	15.0	20.0	pF
				Cg2p	4.2	5.2	pF
				Cg1p	---	0.065	pF
				Cpk	---	0.013	pF
				Cg2k	0.20	0.45	pF

See footnotes at end of table.

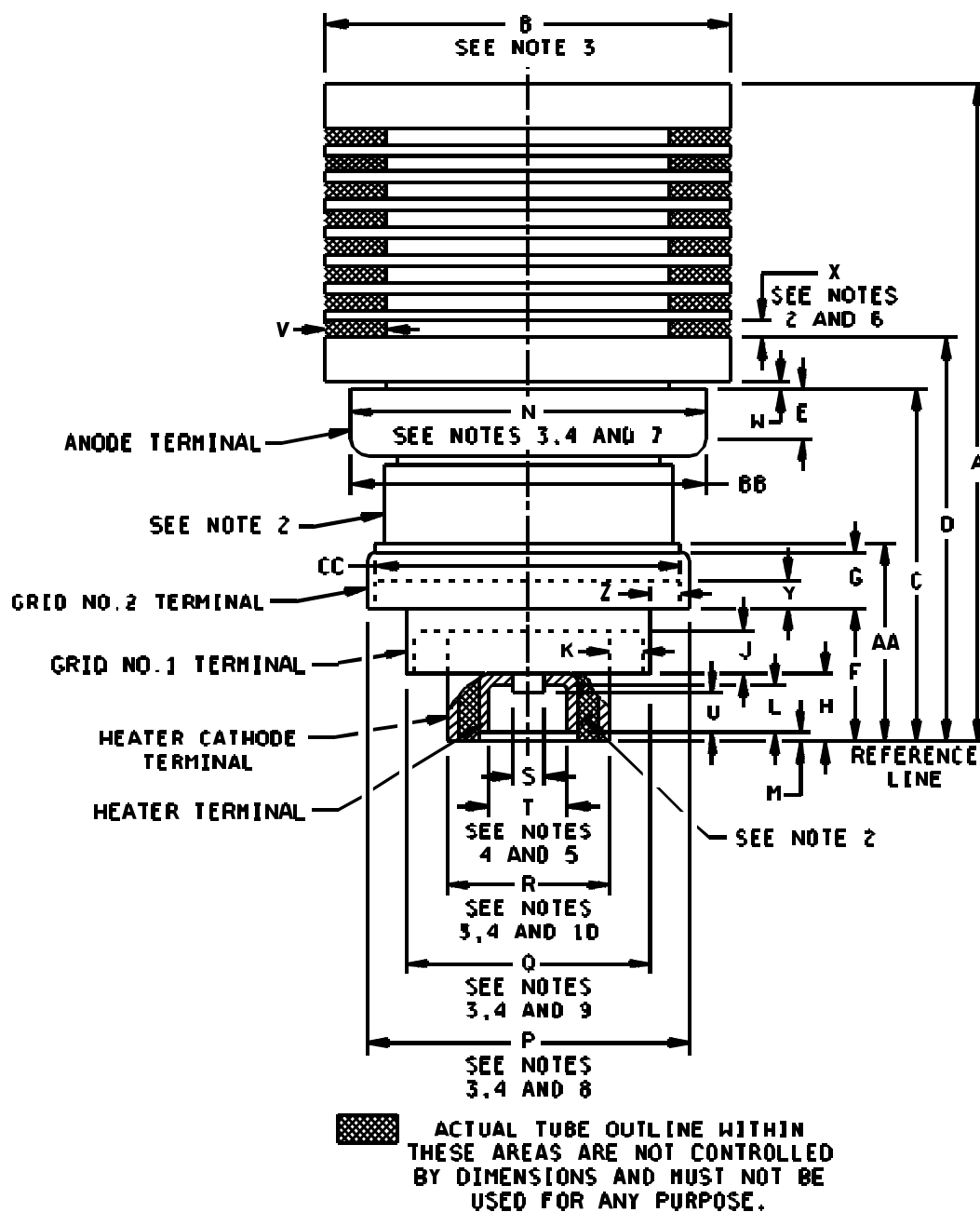
TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Condition	Symbol	Limits		Unit
					Min	Max	
<u>Conformance inspection, part 3</u>							
Life test	---	<u>Z/</u>	Group C; Ib = 180 mA dc; F = 400 \pm 20 MHz; Ic1 = 30 mA dc (max); Ec1 = value obtained for Ec1 in electrode voltage (2) test in accordance with part 1 herein; Type 6816 Ef = 5.7 V Type 6884 Ef = 24.0 V	t	500	---	hours
Life-test end points:	---						
Pulsing emission	2214	---	etd/ik = 7.5 a	etd	---	400	v
Primary grid emission (control)	1266	---		Isg1	---	-4.0	μ A dc
Primary grid emission (screen)	1266	---		Isg2	---	-4.0	μ A dc
Power output	2214	---		Po	70	---	W (useful)
Heater-cycling life test	1506	---	Group C; accelerated heater- cycling 2.5 minutes "on", 5 minutes "off" Type 6816 Ef = 8.5 V Type 6884 Ef = 35.0 V	---	384	---	Cycles
Heater-cycling life-test end point:	---						
Heater current	1301	---		If	1.5	2.7	A
Type 6816				If	0.4	0.7	A
Type 6884							
Low-frequency vibration	1031	<u>9/</u>	Ec2 = 250 V dc; Ec1/Ib = 10 mA dc; Rp = 2,000 ohms; Ebb = 300 V dc	Ep	---	300	mV ac
High-frequency vibration	1031	<u>9/</u>	No voltages	---	---	---	---
Shock	1042	<u>9/</u>	Test condition A	---	---	---	---
Vibration and shock-test end points:	---						
Total grid current	1266	<u>Z/</u>	Ec1/Ib = 115 mA dc	Ic1	---	-8	μ A dc
Electrode voltage (1) (grid)	1261	---	Ec1/Ib = 115 mA dc	Ec1	-6	-15	V dc

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

- 1/ The acceptance level for all tests listed under conformance inspection, part 1, shall be 0.65, inspection level II.
- 2/ Because the cathode is subjected to considerable back bombardment as the frequency is increased, with resultant increase in temperature, the heater voltage shall be decreased depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.
- 3/ Unless otherwise specified, sufficient cooling shall be supplied to maintain anode core and seal temperatures below the maximum rating.
- 4/ The maximum dc anode current at the peak of the current curve is 250 mA dc for a signal having a minimum peak-to-average power ratio of 2.0. The maximum rating for a signal having a minimum peak-to-average power ratio of less than 2.0, such as is obtained in single-tone operation, is 180 mA dc. During short periods of circuit adjustment under single-tone conditions, the average anode current may also reach the level of 250 mA dc.
- 5/ Tube shall be tested in a grid-driven amplifier circuit. Adjust Ec1 bias supply and tune circuit for maximum useful power output. The specified driver power (Pd) output shall be measured with a Bird Thru-line Wattmeter, or equivalent. Driving power output equals forward power minus reflected power. Grid voltage supply shall have an effective impedance of 500 ohms maximum.
- 6/ Before subjection to this test, the tube shall be cooled (room ambient temperature) for 30 minutes. Using the test circuit shown on the figure of method 1366, measure the resistance, in both directions, between any two adjacent electrodes (except across the heater terminals). If the resistance value is below that required, repeat this test after a 10-minute interval. If the tube fails again, the tube shall be rejected.
- 7/ Cooling shall be set up to maintain the tube temperature at the hottest point on the tube envelope at $225^{\circ}\text{C} \pm 25^{\circ}\text{C}$. (This setup should be permanent and needs to be verified only as often as required to maintain equipment accuracy.)
- 8/ With anode, grid 1, and grid 2 tied together, apply a pulse voltage source between anode and cathode. Adjust the pulse amplitude until the specified peak cathode current is obtained. Test shall be made at the end of 1 minute or when stability is reached, whichever occurs first. The pulse voltage shall meet the following requirements:
 - a. Pulse duration: 2 μs .
 - b. Pulse repetition rate: 60 Hz.
 - c. Duty factor: 0.00012.
- 9/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. A regular double sampling plan shall be used, with the first sample of three tubes with an acceptance number of zero, and a second sample of three tubes with a combined acceptance number of one. In the event of failure, the test will be made as a part of conformance inspection, part 2, code level D, with an acceptance level of 6.5. The regular "12-calendar month" double sampling plan shall be reinstated after three consecutive samples have been accepted.
- 10/ Revision letters are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.



- G1: Grid 1 terminal (adjacent to cathode and heater terminal).
 G2: Grid 2 terminal (adjacent to anode contact surface).
 P: Anode-terminal contact surface (adjacent to radiator).
 H: Heater terminals (cup at cathode end and cathode terminal).
 K: Cathode terminal (end opposite radiator).

FIGURE 1. Outline drawing of electron tube types 6816 and 6884.

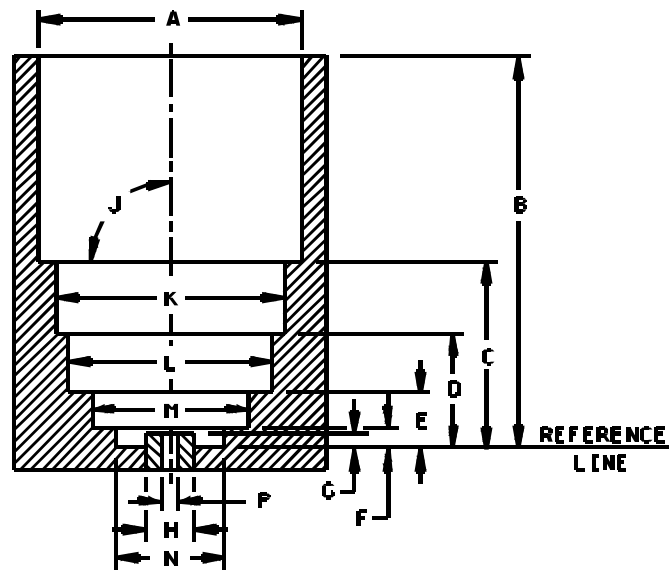
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
Conformance inspection, part 1					4, 14
N	1.085	---	27.56	---	
P	.985	---	25.02	---	
Q	.735	---	18.67	---	
R	.480	---	12.19	---	
T	.240	.260	6.10	6.60	
Conformance inspection, part 2					
A	1.830	1.930	46.48	49.02	
B	1.235	1.265	31.37	32.13	
Conformance inspection, part 3					15
C	1.000	1.060	25.40	26.92	
D	1.090	1.180	27.69	29.97	
E	.165	---	4.19	---	
F	.350	.390	8.89	9.91	
G	.140	---	3.56	---	
H	.160	.190	4.06	4.83	
J	.120	---	3.05	---	
K	.095	---	2.41	---	
L	.100	---	2.54	---	
M	---	.050	---	1.27	
S	---	.072	---	1.83	
U	.054	---	1.37	---	
V	.200	---	5.08	---	
W	.035	---	0.89	---	
X	.050	---	1.27	---	
Y	.060	---	1.52	---	
Z	.090	---	2.29	---	
AA	.600	---	15.24	---	
BB	---	---	---	---	12
CC	---	---	---	---	13

FIGURE 1. Outline drawing of electron tube types 6816 and 6884 - Continued.

NOTES:

1. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
2. Areas between cooling fins, area between anode terminal and grid 2 terminal, and area between heater terminal and heater-cathode terminal shall not be used for any purpose.
3. Maximum dimensions shall be determined by gauge No. 4 (see figure 2.)
4. With cylindrical surfaces of the anode terminal, screen grid terminal, control grid terminal, heater cathode terminal, and heater terminal clean, smooth, and free of burrs, the tube shall enter the gauge No. 4 (see figure 2). Axes of cylindrical holes H1 and H5 and axis of post P shall be concentric within .001 inch (0.03 mm). Seating shall be determined by failure of gauge .125 inch (3.18 mm) wide and .010 inch (0.25 mm) thick to enter between heater cathode terminal and bottom surface of hole H4. A slot in the gauge is provided to permit this measurement to be made.
5. Minimum dimension shall be determined by gauge No. 4 (see figure 2).
6. This dimension to be inspected by inserting gauge .050 inch (1.27 mm) thick minimum between the two fins.
7. Dimension "N" applies to dimension "E" only.
8. Dimension "P" applies to dimension "G" only.
9. Dimension "Q" applies to dimension "F" minus dimension "H" only.
10. Dimension "R" applies to dimension "H" only.
11. In area included between anode terminal and grid 2 terminal, no part of tube shall exceed dimension "P".
12. On any one tube, this dimension shall never be greater than "N".
13. On any one tube, this dimension shall never be greater than "P".
14. The acceptance level for all dimensions listed under conformance inspection, part 1, shall be 1.0, inspection level I.
15. Dimensions shall be checked during the initial production and once each succeeding 12-calendar months in which there is production. A regular double sampling plan shall be used, with the first three tubes with an acceptance number of zero, and a second sample of three tubes with a combined acceptance number of one. In the event of failure, the test will be made as a part of conformance inspection, part 2, code level D, with an acceptance level of 6.5. The regular "12-calendar month" double sampling plan shall be reinstated after three consecutive samples have been accepted.

FIGURE 1. Outline drawing of electron tube type 6816 and 6884 - Continued.



Hole	Limits	
	Min	Max
H1	---	1.120
H2	---	1.020
H3	---	.765
H4	---	.520
H5	---	.072

FIGURE 2. Gauge No. 4.

Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:

DLA - CC

(Project 5960-3537)

Review activities:

Army - AR
Navy - AS, CG, MC, OS
Air Force - 17, 19, 99